

What is claimed is:

1. A method for the delivery of at least one chromosome into a eukaryotic cell, said method comprising subjecting a cell to a laser light pulse under conditions sufficient to form a transient hole in the cell plasma membrane, and introducing at least one chromosome into the cell through said hole, wherein said cell remains viable after introduction of said at least one chromosome.
2. The method according to claim 1, wherein a single chromosome is introduced into said cell.
3. The method according to claim 1, wherein said laser light has a wavelength of about 488 nm.
4. The method according to claim 1, wherein the laser is projected onto the surface of said cell through a microscope lens.
5. The method according to claim 1, wherein said at least one chromosome is greater than about 100 kb in size.
6. The method according to claim 5, wherein said at least one chromosome is in the range of about 100 kb up to about 1,000 kb in size.
7. The method according to claim 5, wherein said at least one chromosome is in the range of about 1,000 kb up to about 30,000 kb in size.
8. The method according to claim 1, wherein said at least one chromosome is less than about 100 kb in size.
9. The method according to claim 1, wherein said at least one chromosome comprises protein.
10. The method according to claim 1, wherein said at least one chromosome comprises in the range of about 40-60% protein by weight.
11. The method according to claim 1, wherein said at least one chromosome comprises about 50% protein by weight.

12. The method according to claim 1, wherein said cells are maintained in a solution comprising phenol red and cell culture material and other agents required to maintain the chromosomes in their condensed (metaphase) state.

13. The method according to claim 12, wherein said laser light is of a wavelength that interacts with phenol red.

14. The method according to claim 1, wherein said insertion of said at least one chromosome is carried out using optical tweezers.

15. The method according to claim 1, wherein said at least one chromosome is fluorescently labeled.

16. The method according to claim 15, wherein insertion of said at least one chromosome is confirmed in a fluorescent activated cell sorter (FACS).

17. An apparatus for the delivery of at least one chromosome into a eukaryotic cell, said apparatus comprising:

- a) a chromosome reservoir,
- b) a cell reservoir,
- c) a laser light source,
- d) an optical tweezer, and
- e) a FACS;

wherein:

said cell reservoir is in fluid communication with said FACS via a cell conduit, said cell conduit comprising a cell gate for admitting a single cell therethrough,

said chromosome reservoir comprises a chromosome conduit in fluid communication with said optical tweezer, said chromosome conduit having a chromosome gate for admitting at least one chromosome therethrough,

said optical tweezer is in fluid communication with said cell conduit at a point downstream from said cell gate,

wherein said laser light source is in optical communication with said cell conduit at a point between said cell gate and said optical tweezer;

such that an individual cell admitted into said cell conduit via said cell gate, passes by said laser light source for treatment by said laser, then proceeds past said optical tweezer for insertion of at least one chromosome, and subsequently proceeds to said FACS for confirmation of introduction of at least one chromosome into said cell.

18. A method for the introduction of at least one chromosome into a eukaryotic cell, said method comprising contacting at least one chromosome with a single cell, said at least one chromosome having sufficient kinetic energy to cause the chromosome to be introduced into said cell, wherein said kinetic energy is imparted to said at least one chromosome via a linear accelerator.

19. A method for the introduction of at least one chromosome into a eukaryotic cell, said method comprising passing at least one charged chromosome through a linear accelerator under conditions sufficient to accelerate said at least one chromosome through the plasma membrane of a cell, and thereby introducing said at least one chromosome into said cell.

20. An apparatus for the delivery of at least one chromosomes into a eukaryotic cell, said apparatus comprising:

- a) a chromosome reservoir,
- b) a cell reservoir,
- c) a linear accelerator and
- d) a FACS;

wherein:

said cell reservoir is in fluid communication with said FACS via a cell conduit, said cell conduit comprising a cell gate for admitting a single cell therethrough,

said chromosome reservoir comprises a chromosome conduit chromosome reservoir in fluid communication with said linear accelerator,

such that an individual cell admitted into said cell conduit via said cell gate, passes by said linear accelerator as at least one chromosome is accelerated therethrough with sufficient kinetic energy to introduce said at least one chromosome into said cell, wherein said cell subsequently proceeds through said FACS for confirmation of

introduction of at least one chromosome into said cell.

21. A method for the introduction of at least one chromosome into a eukaryotic cell, said method comprising contacting an encapsulated at least one chromosome with a cell substantially simultaneously with the application of an electric pulse under conditions sufficient to cause fusion of said encapsulated at least one chromosome with said cell.

22. The method according to claim 21, wherein said at least one chromosome is encapsulated in a liposphere, a liposome or a micell.

23. An apparatus for the delivery of at least one chromosome into a eukaryotic cell, said apparatus comprising:

- a) a chromosome reservoir,
- b) a cell reservoir,
- c) an electric field source, a controlled pump, and
- d) a collection vessel,

wherein:

said cell reservoir is in fluid communication with a conduit junction via a cell conduit, said cell conduit comprising a cell gate for admitting a single cell therethrough,

said chromosome reservoir is in fluid communication with a conduit junction via a chromosome conduit, said cell conduit comprising a chromosome gate for admitting at least one chromosome therethrough,

such that an individual cell admitted into said cell conduit via said cell gate, and at least one encapsulated chromosome admitted into said chromosome conduit via said chromosome gate, are brought into contact at said junction and proceed through a common conduit past said electric field source where the application of an electric pulse causes the fusing of said encapsulated at least one chromosome and said cell thereby introducing said at least one chromosome into said cell.